**CSCI 599 30330 – Assignment 2**

**CONSTRAINED PARTICLE SYSTEM SIMULATION**

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**Q & A’s**

1. **What b value works best?**

**A:** My Constrained Particle System Simulation works well with small BETA values like 0.5, 0.6, 0.7. I Find the system is stable with the above values.

**How To Test :** I have developed a GLUI interface with LIVE variables. BETA value can be changed dynamically and

you can see the results which I have mentioned above.

1. **What happens when the damping parameter b is set too high, or too low?**

**A:** When the BETA value is set too high like

100000 then the system blows up immediately.

10000, 1000, 100 so on.. then the system stays stable even in the vertical equilibrium position

When the BETA value is set too low like

0.2,0.7,…System stays stable for most of the values.

1. **Can you determine b automatically?**

**A:** Based on the amount of variation of the Constraint vector from the value ZERO, the damping parameter can be computed. This computed BETA value is used to make the Constraint vector becomes ZERO. Therefore BETA can be computed automatically.

**TESTCASE**

Momentarily disable CRING and drop the chain from a horizontal position:

1. **Compare the stabilized system (b > 0) to the unstabilized one (b = 0);**

**A:** System behaves very stable without blowing up or vibrating in the the equilibrium position when the BETA value > 0, like 0.6, 0.7, 0.8, 0.9.

1. **Plot the error in the constraints as a function of time.**

**A:** I have plotted the System behavior

**INITIAL POSITION : IN L SHAPE (3o Clock)**

**STABILIZED SYSTEM –> BETA 0.9**

**INITIAL POSITION : IN L SHAPE (3o Clock)**

**UNSTABILIZED SYSTEM –> BETA 0.0**

**INITIAL POSITION : HORIZONTAL**

**STABILIZED SYSTEM –> BETA = 0.9**

**INITIAL POSITION : HORIZONTAL**

**UNSTABILIZED SYSTEM –> BETA = 0.0**

**CONSTRAINED PARTICLE SYSTEM GLUI USER INTERFACE**

**LIGHTING CONTROL PANEL**

**8 Different lights** are setup in the scene and they can be switched on and off dynamically using this panel.

Initially Light 1 and Light 4 are switched on.

**EFFECTS**

**Specularity** – can switch on/off the specularity in the scene

**Emissivity** – can be increased/decreased by checking in the radio button provided.

**Shininess** - can be increased/decreased by checking in the radio button provided.

**FOG**

Grey Coloured fog is implemented in the scene, Three levels of Fog densities can be setup in the scene

**LOW** – Density of 0.1 is used to render the fog

**MEDIUM** - Density of 0.15 is used to render the fog

**HIGH** - Density of 0.2 is used to render the fog

**RING CONTROLS**

Particle System can be simulated on any of the 3 rings present in the scene.

**INNER RING** – radius 0.5

**MIDDLE RING** – radius 0.75

**OUTER RING** – radius 1.0

Colors of the Rings can be changed dynamically

GOLD, MAROON, ORANGE colors are the few colors which are provided through UI.

**PAUSE**

Simulation can be paused in any frame by pressing the “PAUSE” button

**RING**

Ring constraint can be enabled or disabled dynamically while the simulation is running by pressing the “RING” button present in the CONSTRAINT panel.

**ANIMATE**

The walls present in the scene can animated by pressing the “ANIMATE” button present in the UI.

**PARTICLES**

Number of particles in the simulation can be changed dynamically from the UI. Depending upon the selected particle count, the initial position of the particles will be arranged in the 3oClock position and the simulation begings with those many number of particles.

UI allows you to select only odd particle count because only odd number of particles can be arranged evenly in 3oClock orientation. Available number of particles through UI are 3, 5, 7, 9, 11, 13, 15.

**VELOCITY DAMPING**

Particles can be applied with velocity damping “UNDER WATER EFFECT” by checking the radio button for “UNDERWATER” in the DAMPING panel of UI. Damping can be disabled by checking the “ABOVE WATER” radio button.

**LIVE PARAMETERS (Please press “Enter” key everytime you change these variables)**

These are the parameters whose values get changed dynamically depending upon the values you feed these variables while the simulation is going on.

1. TSTEP – live variable which holds the “TIME STEP” value of the simulation. Changing this value will change the time step of the simulation from the very next frame.
2. VDAMP – Velocity damping live variable can be used to dynamically increase/decrease or nullify the velocity damping of the simulation
3. GRAVITY – Dynamic gravitational force can be fed to the simulation through this live variable
4. BETA – This is the parameter used for stabilization of the system. Dynamically change this value and find the response of the system.

**RUN TEST**

This button is used to run the test case mentioned in the assignment pdf. By pressing this button, the system will start simulating from a horizontal initial position with RING constraint disabled (as mentioned in the assignment specification). While this simulation is running, the value of the BETA can be changed to check the system performance and response to the setting provided.

Above are controls for the simulation which I have implemented.

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